Global Climate Change and Public Health

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Global Warming

There is a growing consensus among the scientific establishment that the earth's temperature is warming. The time series in Figure 1 shows, from 1880 to 1998, annual global surface mean temperature anomalies. 1998 was the warmest year since widespread instrument records began in the late Nineteenth Century. Seven of the ten warmest years have occurred in the 1990s.

The cause of this warming is the subject of much debate. Perceived causes include El Niño, deforestation, the urban heat island effect, naturally occurring cyclical warming of the earth's surface, naturally occurring cyclical warming of the sun, and atmospheric pollution caused by man, also known as greenhouse gas emissions. Much attention has been focused on the impact of greenhouse gas emissions because it is one of the few potential factors that can be mitigated.

Greenhouse gases are intensified by the combustion of fossil fuels. See Figure 2. Increased energy use in cars, homes and for industrial purposes raises the concentrations of carbon dioxide (CO_2) and other gases in the atmosphere. CO_2 has increased 30 percent, from 280 to 360 parts per million, since 1860. The overall emissions of greenhouse gases are growing at about one percent per year. Fluctuations in temperature and CO_2 have mirrored each other for 160,000 years. CO_2 levels are higher now than any time during that period. Predictions related to the effect of greenhouse gases include:

1. Atmospheric concentrations of CO_2 and other gases will continue to increase;

2. Increases in the concentrations of these gases will lead to changes in climate such as temperature, precipitation, and storm frequency and severity; and

3. Changes in climate will have significant economic, ecosystem and human health effects.

The Public Health Impact

Factors that affect the vulnerability of certain populations, such as poor sanitation, crowding, poverty and food scarcity, make it difficult to quantify the impact of global warming in terms of lives lost or further deterioration in the quality of life for most of the world's population. However, extreme climatic changes for which vulnerable populations are not prepared would most certainly increase hunger, homelessness, and diseases such as malaria and typhoid.

Here in Missouri, a few degrees increase in global warming would cause localized variances in weather conditions that could be extreme. Cold spells still would occur in winter but hotter temperatures in the summer would be more extreme and more common. Missouri already experiences irregular, intense heat waves that impact on health. For example, in Missouri there were 819 heat-related illnesses reported in 1995, 512 reported in 1990 and 470 reported in 1998, but only 35 reported in 1992. The final analysis of heat-related mortality is not complete as

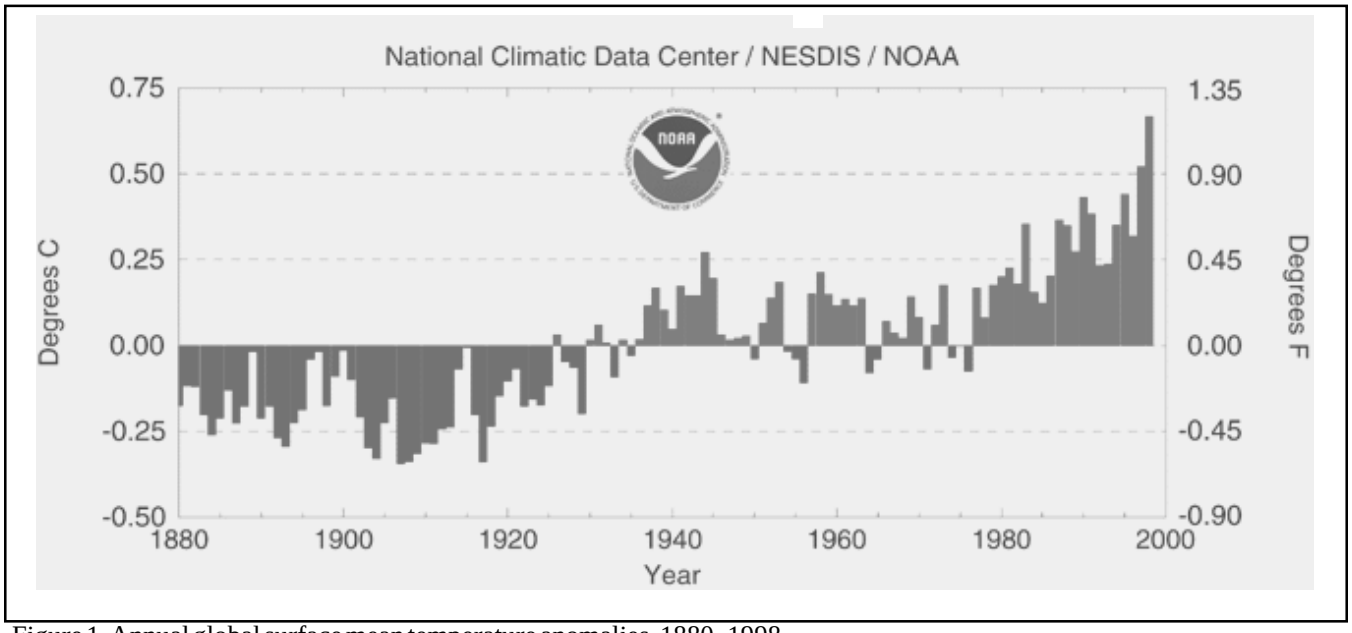

Figure 1. Annual global surface mean temperature anomalies, 1880–1998.

of this writing, but there may be in excess of 65 heat-related deaths in 1999 compared to 12 in 1998 and 9 in 1997. See Figures 3 and 4. During 1979–96, the years for which data are available, Missouri had the second highest age-adjusted rate for heat-related deaths "due to weather conditions" (3 per million population) in the United States.

Fluctuations in weather patterns would cause some areas to become drier and other areas to become wetter, therefore changing and possibly expanding the habitat of disease-carrying insect vectors. Nighttime temperatures are rising faster than daytime temperatures. The range of many disease-carrying insects is limited by nighttime temperatures. Mosquitoes are common vectors in Missouri. If the climate becomes wetter and warmer, mosquito populations could increase, thereby increasing the risk of exposures to the diseases which they carry. For example, St. Louis encephalitis, Eastern equine encephalitis, and LaCrosse encephalitis are more common in years when the temperature is higher than normal. Malaria kills an estimated two million people a year worldwide. In recent years, cases of malaria contracted from local mosquitoes have been reported in New York, New Jersey, Virginia, Texas, Georgia, Florida and Michigan.

If weather patterns change, storms could become more intense. Precipitation could come in intense, short bursts causing more localized flash flooding. Severe weather such as high winds and tornadoes could increase. No one can forget the devastating floods of 1993, but many do not know that in 1998, 18 lives were lost in Missouri due to flooding. With an increased volatility in climate, health problems associated with natural disasters would increase.

Finally, ground level ozone air pollution concentrations increase during heat waves. Ozone is a major component of smog that has been shown to reduce lung function, induce respiratory inflammation, and aggravate respiratory illnesses such as asthma. Asthma affects

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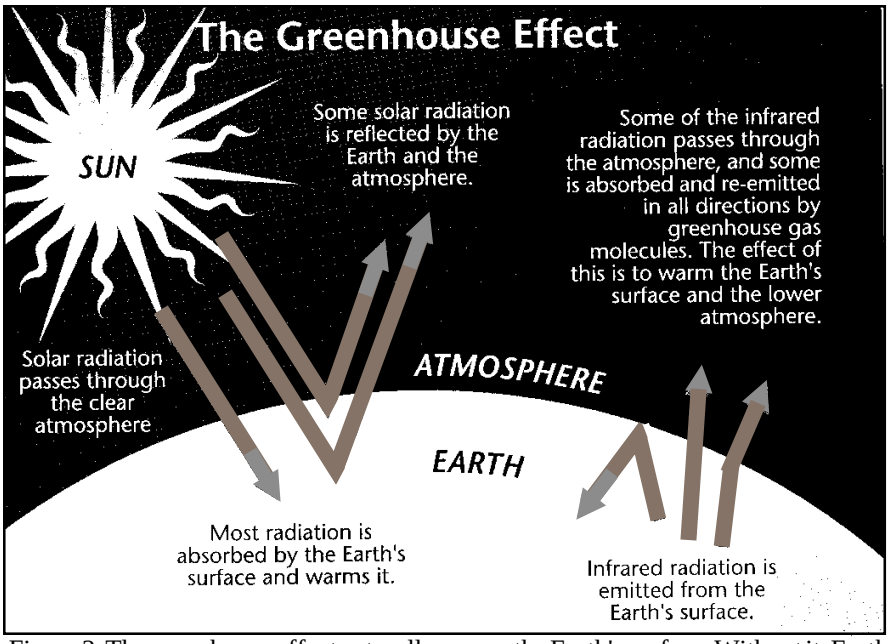

Figure 2. The greenhouse effect naturally warms the Earth's surface. Without it, Earth would be 60° F cooler than it is today—uninhabitable for life as we know it.

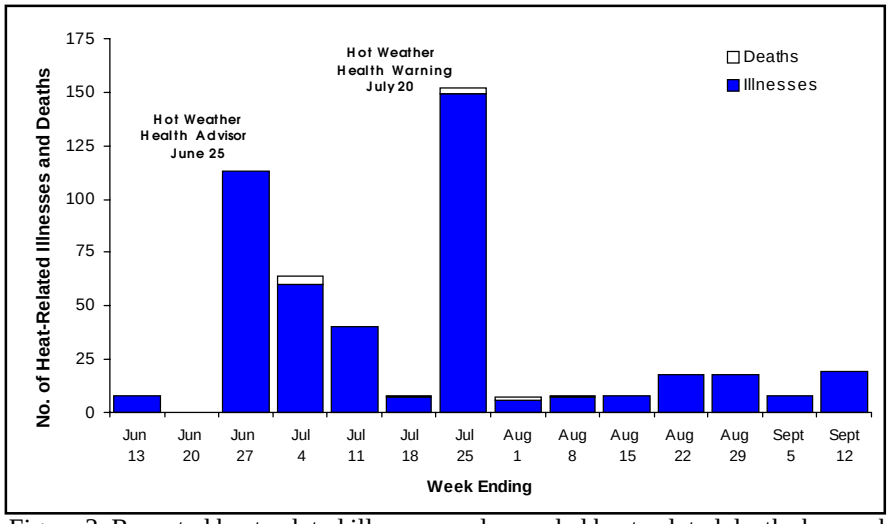

Figure 3. Reported heat-related illnesses and recorded heat-related deaths by week of occurrence, Missouri, Summer 1998.

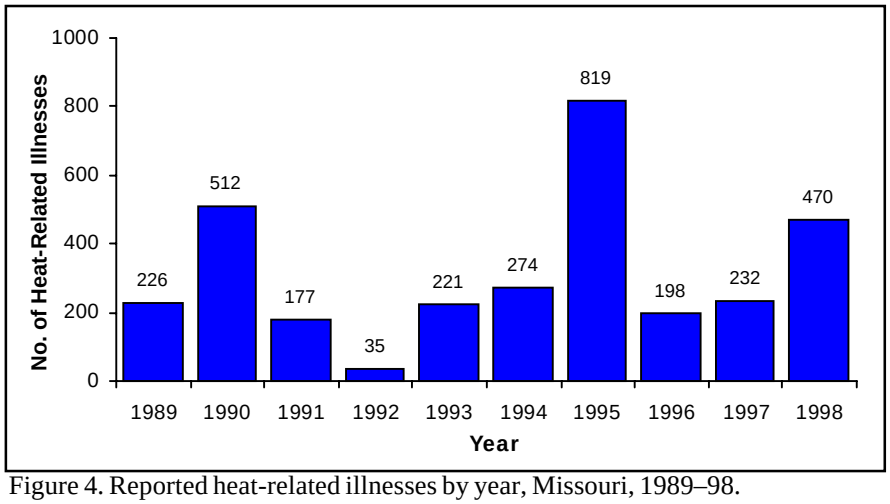

Figure 4. Reported heat-related illnesses by year, Missouri, 1989–98.

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over 14 million Americans, including five million children. In 1990, the estimated cost of asthma was $6.2 billion and by 2000 it is expected to reach $14.5 billion. St. Louis is already classified as a moderate nonattainment area for ozone.

What Public Health Leaders Can Do

Although the debate continues as to a final determination of cause, public health officials are beginning to study the implications of global warming and develop mitigation plans for potential increases in population-based illnesses such as vector-borne or heat-related illnesses. Public health leaders have learned that, in public health as in medicine, sometimes it is critical to begin treatment before being absolutely sure of what is wrong.

Disease outbreaks are impacted by a complex system of biological, infrastructure and environmental factors that are easier dealt with by industrialized, wealthy nations. For example, cholera will probably not become a threat in epidemic proportions in Missouri as long as water treatment systems are maintained and effective. In 1995, six cases of dengue fever were reported in Texas, while 4,000 were reported in close proximity, in Mexico. The low case rate in Texas has been attributed to better housing, air conditioning, vector control programs and socioeconomic conditions.

Dr. Denny Donnell, Missouri State Epidemiologist, says "Considering the high number of heat-related illnesses reported in Missouri in 1998, one would expect to have seen more heat-related deaths. This lower number of deaths may reflect the effectiveness of public health efforts to educate the public to recognize heat-related illness and seek medical treatment promptly."

After a severe heat emergency in 1980 that took 294 lives in Missouri, the state and the municipalities of St. Louis, Kansas City and Springfield took steps to plan for future heat waves. The top ten leading factors that put people at risk have been identified. These include the inability to care for oneself, such as the very young or elderly. Also, urban building design with flat, black roofs and poor air circulation creates a risk for those living on the top floor of a building. City and social service agencies have signed formal contracts to coordinate services. The Salvation Army and Red Cross provide shelters, the AmerenUE utility company provides window air conditioners on loan, and senior centers reach out to high-risk seniors. Finally, state and city officials have agreed on a common language for hot weather health advisories.

In March 1998, the Environmental Protection Agency, the Centers for Disease Control and Prevention, the American Medical Association, the American Public Health Association, the National Environmental Health Association and the National Institutes of Health co-sponsored the first joint conference on *Emerging Public Health Threats and the Role of Climate Change*. This conference signified the first major step toward the realization that public health leaders must define their role and accept accountability to respond to this public health threat.

In order for public health officials in Missouri to meet this challenge, they should consider the following key responsibilities:

- Identifying the diseases associated with changing climatic conditions through better research and surveillance techniques;
- Understanding the complex systems impacting public health, including climatic changes;
- Assessing the risks to certain vulnerable populations such as the poor, elderly or the very young;
- Informing the public of emerging trends in disease;
- Informing the public about how to minimize their risk;
- Encouraging interventions like heat warning systems, better urban building design and energy conservation;
- Improving our emergency response capacity and early warning systems;
- Involving non-governmental community agencies and private entities in the development of effective interventions

Public health leaders have effectively identified significant risks to public health over the past century. They have identified the need for better sanitation practices, declared smoking a public health risk, spoken out about sexually transmitted diseases, identified violence as a public health risk, and developed interventions to help curtail illness associated with both communicable and chronic diseases. Recognizing global warming as a potential public health threat that can be mitigated through traditional public health interventions and practices is critical to the public health system's readiness to reduce illness and death associated with extreme climatic events.

Thanks to Lauren Holtkamp for her assistance in obtaining statistics for this article.

See pages 19–20 for 20 simple steps that you and your family can take to help reduce global warming.

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3. Executive Office of the President, Office of Science and Technology.

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20 Simple Steps to Reduce Global Warming

Whenever you save energy—or use it more efficiently—you reduce the demand for gasoline, oil, coal and natural gas. Less burning of these fossil fuels means lower emissions of carbon dioxide, the major contributor to global warming. Right now the United States releases about 40,000 pounds of carbon dioxide per person each year. If we can reduce energy use enough to lower greenhouse gas emissions by about 2% a year, in ten years we will "lose" about 7,000 pounds of carbon dioxide emissions per person.

Here are 20 simple steps that can help cut your annual emissions of carbon dioxide by thousands of pounds. The carbon dioxide reduction shown for each action is an average saving.

HOME APPLIANCES

1. Run your dishwasher only with a full load. Use the energy-saving setting to dry the dishes. Don't use heat when drying.
   Carbon dioxide reduction: 200 pounds a year.

2. Wash clothes in warm or cold water, not hot.
   Carbon dioxide reduction (for two loads a week): up to 500 pounds a year.

3. Turn down your water heater thermostat; 120 degrees is usually hot enough.
   Carbon dioxide reduction (for each 10-degree adjustment): 500 pounds a year.

HOME HEATING AND COOLING

4. Don't overheat or overcool rooms. Adjust your thermostat (lower in winter, higher in summer).
   Carbon dioxide reduction (for each 2-degree adjustment): about 500 pounds a year.

5. Clean or replace air filters as recommended. Cleaning a dirty air conditioner filter can save 5% of the energy used.
   Carbon dioxide reduction: About 175 pounds a year.

SMALL INVESTMENTS THAT PAY OFF

6. Buy energy-efficient compact fluorescent bulbs for your most-used lights.
   Carbon dioxide reduction (by replacing one frequently used bulb): about 500 pounds a year.

7. Wrap your water heater in an insulating jacket.
   Carbon dioxide reduction: Up to 1,000 pounds a year.

8. Install low-flow shower heads to use less hot water.
   Carbon dioxide reduction: Up to 300 pounds a year.

9. Caulk and weatherstrip around doors and windows to plug air leaks.
   Carbon dioxide reduction: Up to 1,000 pounds a year.

10. Ask your utility company for a home energy audit to find out where your home is poorly insulated or energy-inefficient.
    Carbon dioxide reduction: Potentially, thousands of pounds a year.

GETTING AROUND

11. Whenever possible, walk, bike, carpool or use mass transit.
    Carbon dioxide reduction (for every gallon of gasoline you save): 20 pounds.

12. When you buy a car, choose one that gets good gas mileage.
    Carbon dioxide reduction (if your new car gets 10 mpg more than your old one): about 2,500 pounds a year.

REDUCE, REUSE, RECYCLE

13. Reduce waste: Buy minimally packaged goods; choose reusable products over disposable ones; recycle.
    Carbon dioxide reduction (if you cut down your garbage by 25%): 1,000 pounds a year.

14. If your car has an air conditioner, make sure its coolant is recycled whenever you have it serviced.
    Equivalent carbon dioxide reduction: Thousands of pounds.

HOME IMPROVEMENTS

15. Insulate your walls and ceilings; this can save about 25% of home heating bills.
    Carbon dioxide reduction: Up to 2,000 pounds a year.

16. If you need to replace your windows, install the best energy-saving models.
    Carbon dioxide reduction: Up to 10,000 pounds a year.

17. Plant trees next to your home and paint your home a light color if you live in a warm climate, or a dark color in a cold climate.
    Carbon dioxide reduction: About 5,000 pounds a year.

18. As you replace home appliances, select the most energy-efficient models.
    Carbon dioxide reduction (if you replace your old refrigerator with an efficient model): 3,000 pounds a year.

SCHOOLS, BUSINESS, AND COMMUNITIES

19. Reduce waste and promote energy-efficient measures at your school or workplace. Work in your community to set up recycling programs.
    Carbon dioxide reduction (for every pound of office paper recycled): 4 pounds.

20. Be informed about environmental issues. Keep track of candidates' voting records and write or call to express concerns.
    Carbon dioxide reduction (if we vote to raise U.S. auto fuel efficiency): Billions of pounds.

Source: Environmental Defense Fund Web Site at **http://www.edf.org**.